Pahsimeroi River Summer Chinook Salmon Population
Population Viability Assessment

The Pahsimeroi River chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings (MPGs), including: Lower Snake River, Grande Ronde / Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The ESU contains both spring and summer run chinook. The Pahsimeroi River population is a summer run and is one of eight extant populations in the Upper Salmon River MPG.

The ICTRT classified the Pahsimeroi River population as a "large" population (Table 1) based on historical habitat potential (ICTRT 2005). A chinook population classified as large has a mean minimum abundance threshold criteria of 1000 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

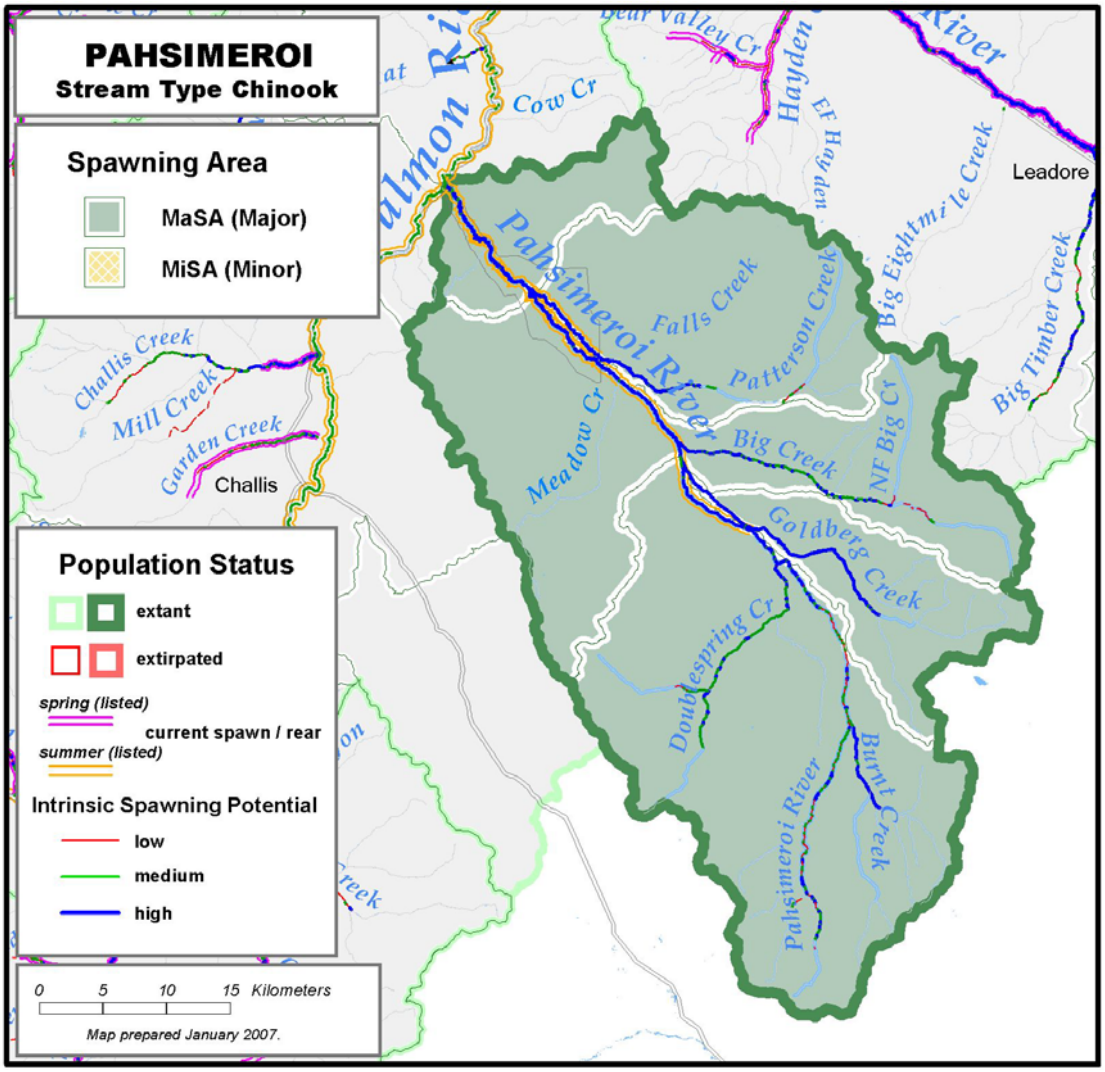

Figure 1. Pahsimeroi River chinook major and minor spawning areas.

Table 1. Pahsimeroi River chinook basin statistics

Drainage Area (km2)	2,152
Stream lengths km* (total)	372
Stream lengths km* (below natural barriers)	368
Branched stream area weighted by intrinsic potential (km2)	1.053
Branched stream area km2 (weighted and temp. limited)	1.053
Total stream area weighted by intrinsic potential (km2)	1.109
Total stream area weighted by intrinsic potential (km2) temp limited	1.109
Size / Complexity category	Large / "B" (dendritic structure)
Number of MaSAs	5
Number of MiSAs	0

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1986 to 2005) abundance (number of adults spawning in natural production areas) has ranged from 27 in 1995 to 763 in 2003 (Figure 2). Annual abundance estimates for the Pahsimeroi River were based on weir counts. Insert expansion methodology here

Recent year natural spawners include returns originating from naturally spawning parents, and adults returning from supplementation program releases. Hatchery fish from the mitigation hatchery program now are removed from the run at the hatchery weir approximately one-half mile upstream of the river's mouth. It is assumed that the weir is 100% effective and hatchery fish are precluded from reaching the spawning area. Adult releases above the weir, prior to implementing a 100%-marked hatchery juvenile release management strategy, included unmarked natural and hatchery origin fish. Spawners originating from naturally spawning parents have comprised an average of 30% since 1986, while the most recent 10-year average of naturally spawning parents is 60% (Table 2).

Abundance in recent years has been highly variable, the most recent 10-year geomean number of natural origin spawners was 112 (Table 2). During the period 1986-2000, returns per spawner for chinook in the Lower Salmon River ranged from 0.02 in 1990 to 2.96 in 1998. The most recent 20 year (1981-2000) SAR adjusted and delimited (at 75% of the size threshold) geometric mean of returns per spawner was 0.41 (Table 2).

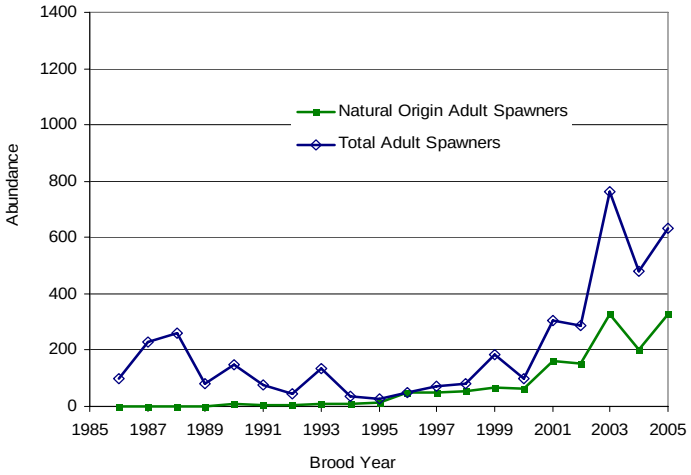

Figure 2. Pahsimeroi River abundance trends 1986-2005.

Table 2. Lower Salmon River abundance and productivity measures

10-year geomean natural abundance	112
20-year return/spawner productivity	0.39
20-year return/spawner productivity, SAR adj. and delimited*	0.41
20-year Bev-Holt fit productivity, SAR adjusted	n/a
20-year Lambda productivity estimate	1.08
Average proportion natural origin spawners (recent 10 years)	0.60
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size category threshold for this population. This approach attempts to remove density dependence effects that may influence the productivity estimate. However, there were no parent escapements above 75% of the threshold for this population.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 15-yr geomean R/S (adjusted for marine survival and delimited at 750 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Pahsimeroi River chinook population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

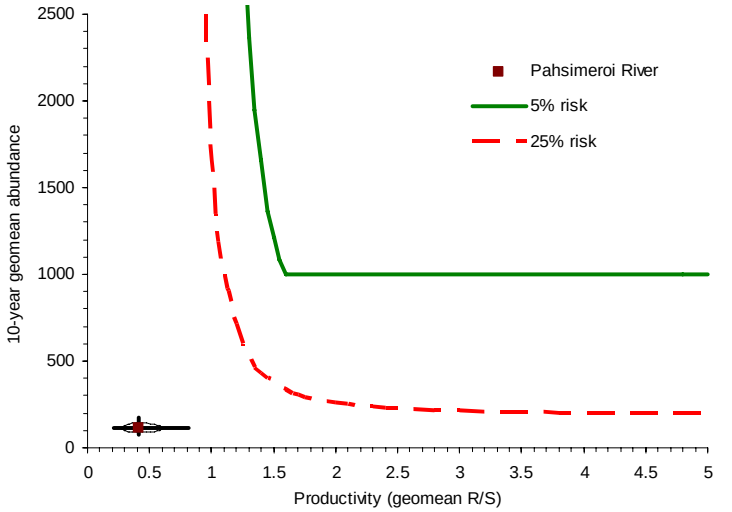

Figure 3. Pahsimeroi River Summer Chinook abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at 75% threshold. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.75 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified five major spawning areas (MaSA) and no minor spawning areas (MiSA) within the Pahsimeroi River chinook population. There are no modeled temperature limitations within this MaSA. Current core spawning areas are from Burstedt Lane Bridge to Dowton Lane Bridge.

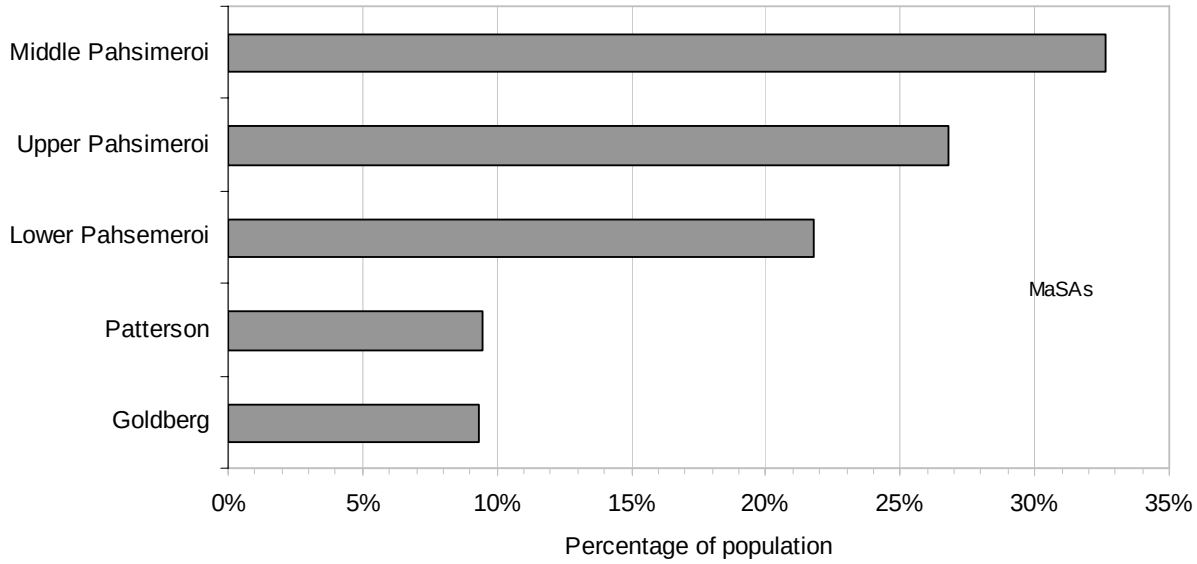

Figure 4. Proportions of the five MaSAs that comprise the Pahsimeroi River Summer Chinook salmon population. There are no modeled temperature limitations in the population.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.
The Pahsimeroi River population of summer Chinook salmon has five MaSAs and no MiSA. This metric is rated *Low Risk* because of the number of MaSAs and their spatial arrangement. Spawning occurs in the mainstem Pahsimeroi River. Current core spawning areas are from Burstedt Lane Bridge to Dowton Lane Bridge.

A.l.b. Spatial extent or range of population.

The IDFG has conducted annual spawner index counts since 1957 on the mainstem Pahsimeroi River from its mouth upstream to the Dowton Lane Bridge. The upper bound of the index area does vary slightly across years, but in all years the index area only covers spawning areas in the lower MaSAs. This metric is rated *Moderate Risk* because current spawning distribution occupies only 50% of the historic MaSAs.

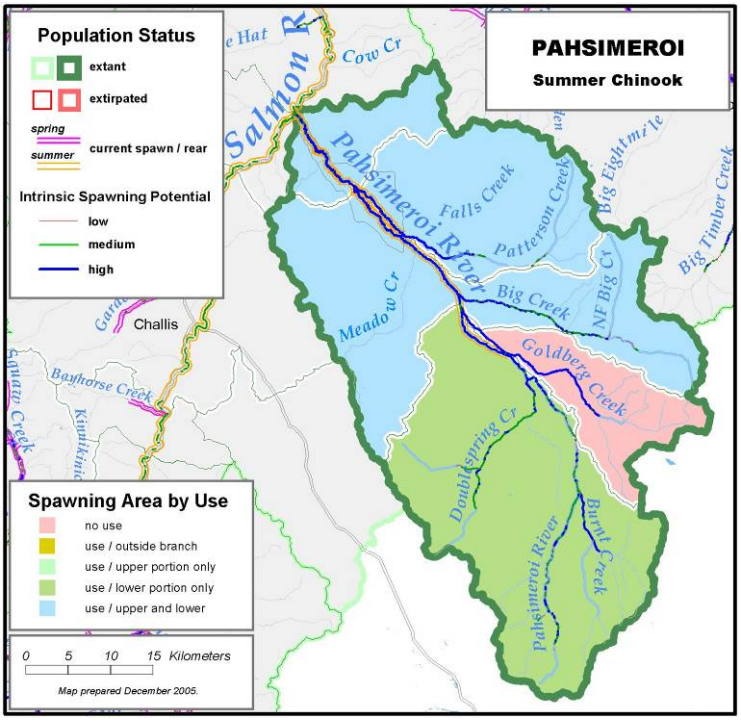

Figure 5. Pahsimeroi River chinook distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning areas.
The upper MaSAs are not occupied; fish are precluded from reaching these areas because of irrigation-related impacts (barriers and flow reductions). This metric is rated *High Risk*; neither of the MaSAs in the upstream population area is occupied.

B.1.a. Major life history strategies.
There are limited data to allow any comparisons between historic and current life history strategies. The major adult life history strategy is summer run timing. The known major juvenile life history strategy is a spring yearling migrant. Substantial anthropogenic impacts have occurred that could have resulted in loss of variability or change in a life history strategy. Modification of the hydrologic regime as a result of irrigation practices and blockage of access to upstream areas may affect variability of life history strategies. Although data are limited, it is assumed that all historical pathways are present and there has not been a significant reduction in

variability or substantial change in relative distribution of pathways, and the metric is rated *Low Risk*.

B.1.b. Phenotypic variation.
There is no data to indicate that any phenotypic traits have been significantly changed or lost. Considering the potential impacts of irrigation activities discussed above, there is no evidence these activities have resulted in loss of a phenotypic trait. Land use activities may impart major selective pressures which would cause significant changes in or loss of traits. Since there is no direct evidence for loss or substantial change in phenotypic traits; this metric is rated at *Low Risk.*

B.1.c. Genetic variation.
Genetic ratings were based on IC-TRT analysis of allozyme data presented in Waples et al. 1993. In addition, the IC-TRT analyzed WDFW and R. Waples, unpublished allozyme data, and P. Moran, unpublished microsatellite data. The samples for natural fish are not significantly different from 28 hatchery fish samples. This metric was rated *High Risk.*

B.2.a. Spawner composition.
Spawner composition is mainly determined from recovery of tags from fish trapped at the Pahsimeroi Fish Hatchery. Any marked fish that are recovered are examined for the presence of a coded-wire or PIT tag. From 1980 through 2004 551 marked fish were recovered in the population (at Pahsimeroi Fish Hatchery) and a CWT was extracted and read from all fish.

(1) *Out-of-ESU strays*. One out-of-ESU fish was trapped in 1984; its origin was the Rogue River in Oregon. No expansions were done to account for unmarked returns from the respective mark groups. This sub-metric is rated *Very Low* risk since no strays have been observed in recent years and the total number observed was very low.

(2) *Out-of-MPG strays from within the ESU*. Four out-of-MPG strays were recovered at the Pahsimeroi Fish Hatchery over 24 years of data surveyed. All were Rapid River stock; two (one each in 1988 and 1999) were reared and released at Rapid River and two (one each in 1976 and 1977) were reared in a facility on Hayden Creek (tributary to the Lemhi River). No expansions were done to account for unmarked returns from the respective mark groups. This sub-metric is rated *Low* risk.

(3) *Out of population within MPG strays*. Strays in this category would originate from the upstream Upper Salmon River Mainstem or East Fork Salmon River population. The hatchery program in the East Fork Salmon River released fish only from 1984 through 1993 and most releases were less than 300,000 smolts. No out-of-population strays have been detected in the population, and this sub-metric is rated *Very Low* risk.

(4) *Within-population hatchery spawners.* Hatchery-origin spawners that have been observed in the population in recent years originated from the within-population Pahsimeroi Hatchery program. The calculated proportion of naturally spawning hatchery origin fish ranged from 29% to 100% per year since 1985, but was 4% in 1996. The average proportion of hatchery origin spawners for the period 1997-2005 was 47%. Regardless of whether best hatchery management

practices are used, this sub-metric is rated *High Risk*. For the most recent generation (2001-2005) hatchery origin natural spawners ranged from 47% to 58%, and averaged 51%.

The overall risk rating for metric B.2.a "spawner composition" is *High Risk* because of the high proportions of hatchery origin fish spawning naturally.

B.3.a. Distribution of population across habitat types.

The Pahsimeroi River population intrinsic potential distribution historically was distributed across two EPA level IV ecoregions, with the Dry Intermontane Sagebrush Valleys being predominant. (The Barren Mountains ecoregion is represented in less than 1% of the spawning area, and is excluded from consideration here.) All historically occupied ecoregions are currently occupied (Table 3 and Fig. 6). The Dry Gneissic-Schistose-Volcanic Hills ecoregion currently is not occupied, but since it covered less than 5% of the historic spawning area, this metric was rated *Low Risk* for the population.

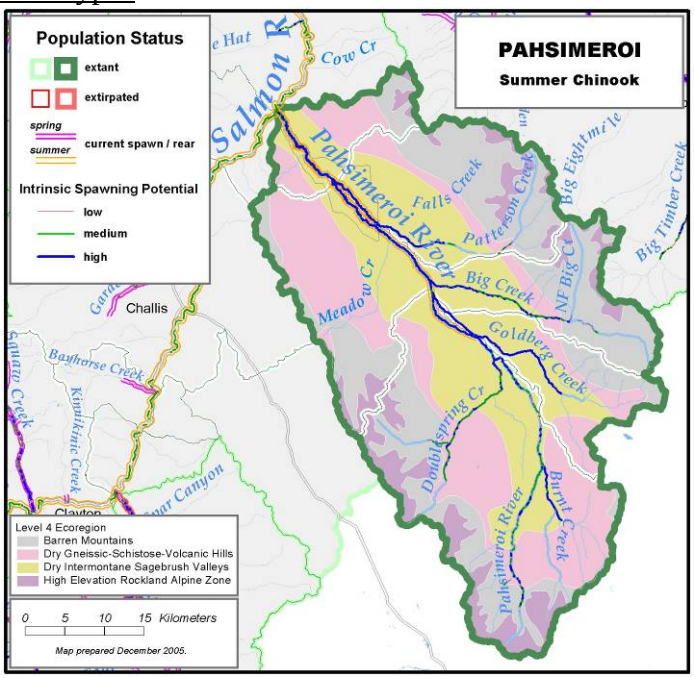

Figure 6. Pahsimeroi River chinook population distribution across various ecoregions.

Table 3. Pahsimeroi River chinook—proportion of spawning areas across various ecoregions.

Ecoregion	% of historical branch spawning area in this ecoregion (non-temperature limited)	% of historical branch spawning area in this ecoregion (temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Barren Mountains	0.7	0.7	0.0
Dry Gneissic-Schistose-Volcanic Hills	4.6	4.6	0.0
Dry Intermontane Sagebrush Valleys	94.7	94.7	100.0

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on smolt outmigrants and adult migrants, the selective mortality is not likely to remove

more than 25% of the affected individuals. The likely impacts are rated as *Low Risk* for this action.

Harvest: Recent harvest impact rates for spring/summer Chinook salmon are generally less than 10% annually. There are no freshwater fisheries directly targeting naturally produced spring/summer Chinook salmon; indirect mortalities are expected to occur in some fisheries selective for hatchery fish. In 2005 there was a limited sport fishery in the mainstem Salmon River just downstream of the Pahsimeroi River to target marked hatchery summer Chinook salmon. Some indirect mortalities were expected to occur through the execution of the fishery. It is not likely that the mortality is selective for a particular group of fish or if it is, it would not select 25% or more of that particular group and this action is as *Very Low Risk*.

Hatcheries: This action is rated *High Risk*. The duration of the activity exceeds one generation, the activity is ongoing and the entire population is affected.

Habitat: It is unknown to what extent habitat alterations may have resulted in selective change on the population. Because habitat alterations affect the entire population, this metric is rated *Moderte Risk*.

Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *High Risk* for the Pahsimeroi River population (Table 4). This risk rating is driven by the score for genetic variation and the high proportions of hatchery fish spawning naturally. Spatial structure of the population also is a major issue. Unless the distribution of fish can be expanded into currently unoccupied (blocked) areas, spatial structure/diversity risk can never be rated better than Moderate.

Table 4. Spatial structure and diversity scoring table

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Moderate Risk
(Mean=0)</td><td rowspan="3">Moderate Risk (0)</td><td rowspan="15">High Risk</td></tr>
<tr><td>A.1.b</td><td>M (0)</td><td>M (0)</td></tr>
<tr><td>A.1.c</td><td>H (-1)</td><td>H (-1)</td></tr>
<tr><td>B.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">High Risk
(-1)</td><td rowspan="10">High Risk</td></tr>
<tr><td>B.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.c</td><td>H (-1)</td><td>H (-1)</td></tr>
<tr><td>B.2.a(1)</td><td>VL (2)</td><td rowspan="4">High Risk
(-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(3)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(4)</td><td>H (-1)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.4.a</td><td>H (-1)</td><td>H (-1)</td><td>H (-1)</td></tr>
</table>

Overall Viability Rating

The Pahsimeroi River spring/summer Chinook salmon population does not currently meet viability criteria because neither Abundance/Productivity risk nor Spatial Structure/Diversity risk meets the criteria for a viable population (Table 5). The 20-year delimited recruit per spawner point estimate is 0.41, significantly less than the 1.45 required at the minimum threshold abundance. The 10-year geometric mean abundance (112) is 11% of the minimum threshold abundance. Substantial improvements in abundance/productivity status (reduction of risk level) and spatial structure/diversity status will need to occur before the population can be considered viable.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	
	High (>25%)				**Pahsimeroi**

Figure 7. Viable Salmonid Population parameter risk ratings for the Pahsimeroi River Summer Chinook population. This population is not currently meeting viability criteria. *Viability Key: HV – Highly Viable; V – Viable; M – Maintained; Shaded cells-- not meeting viability criteria (darkest cells are at greatest risk)*

Pahsimeroi River Summer Chinook – Data Summary

Data type: Weir counts
SAR: Averaged Williams/CSS series

Table 5. Pahsimeroi River Chinook run data (used for curve fits and R/S analysis). All available return/spawner data were used since the parent escapement never exceeded 75% of the size threshold.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1986	**100**	**0.00**	**0**	**10**	**0.10**	**1.35**	**13**	**0.13**
1987	**228**	**0.00**	**0**	**4**	**0.02**	**1.70**	**7**	**0.03**
1988	**260**	**0.00**	**0**	**11**	**0.04**	**0.74**	**8**	**0.03**
1989	**82**	**0.01**	**1**	**3**	**0.03**	**1.58**	**4**	**0.05**
1990	**149**	**0.05**	**7**	**3**	**0.02**	**4.57**	**13**	**0.09**
1991	**75**	**0.08**	**6**	**32**	**0.43**	**3.00**	**96**	**1.28**
1992	**43**	**0.07**	**3**	**64**	**1.48**	**1.65**	**105**	**2.44**
1993	**136**	**0.08**	**11**	**63**	**0.47**	**1.59**	**101**	**0.74**
1994	**36**	**0.28**	**10**	**26**	**0.73**	**1.02**	**27**	**0.75**
1995	**27**	**0.56**	**15**	**63**	**2.33**	**0.59**	**37**	**1.37**
1996	**51**	**0.96**	**49**	**106**	**2.09**	**0.54**	**57**	**1.12**
1997	**72**	**0.71**	**51**	**165**	**2.29**	**0.29**	**48**	**0.67**
1998	**80**	**0.65**	**52**	**237**	**2.96**	**0.30**	**70**	**0.88**
1999	**184**	**0.38**	**69**	**194**	**1.05**	**0.64**	**125**	**0.68**
2000	**98**	**0.64**	**63**	**216**	**2.20**	**1.00**	**215**	**2.19**
2001	306	0.53	163					
2002	286	0.53	152					
2003	763	0.43	328					
2004	481	0.42	200					
2005	633	0.52	328					

Table 6. Geomean abundance and productivity measures. Boxed values were used in evaluating the current status of this population.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1989-2000	1986-2000	geomean
Point Est.	1.48	0.39	1.12	0.41	1.15	1.08	112
Std. Err.	0.27	0.50	0.17	0.39	0.20	0.26	0.24
count	10	20	10	20	12	15	10

Table 7. Poptools stock-recruitment curve fit parameter estimates. Values potentially indicating a non-fit are highlighted in gray.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.39	0.19	n/a	n/a	1.20	0.81	66.0	0.40	0.15	n/a	n/a	0.85	0.79	59.5
Const. Rec	34	14	n/a	n/a	n/a	n/a	60.5	36	11	n/a	n/a	n/a	n/a	52.3
Bev-Holt	50.00	291.63	35	14	0.76	0.82	63.7	50.00	204.29	36	11	0.56	0.77	55.5
Hock-Stk	0.50	0.29	10000	0	1.22	0.81	69.5	0.50	0.22	10000	0	0.86	0.79	63.0
Ricker	2.50	1.72	0.01722	0.00540	1.27	0.62	61.6	2.11	1.09	0.01531	0.00406	0.84	0.51	52.7

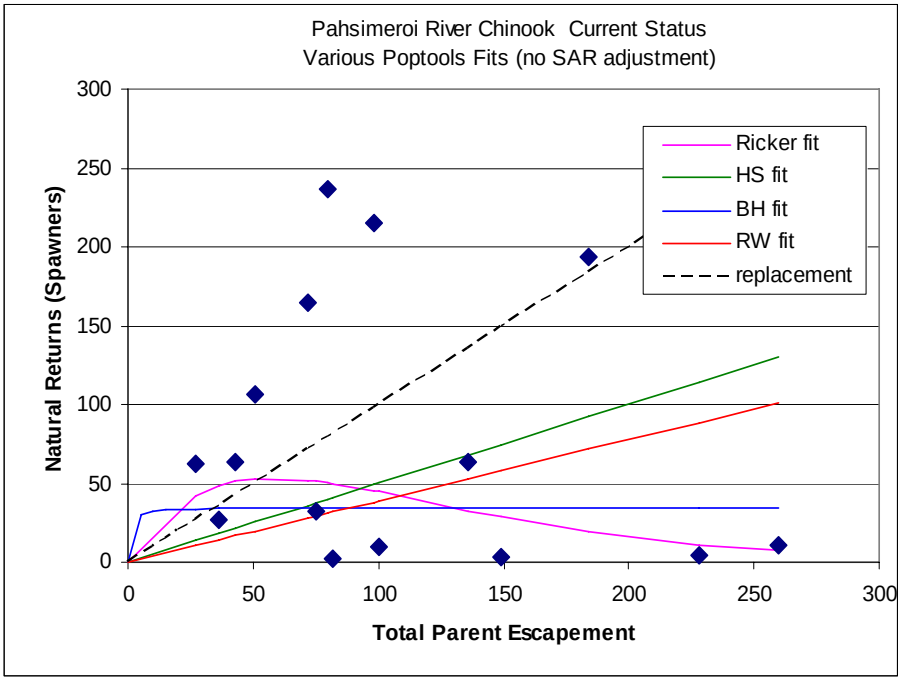

Figure 8. Stock recruitment curves for the Pahsimeroi River chinook population. Data not adjusted for marine survival.

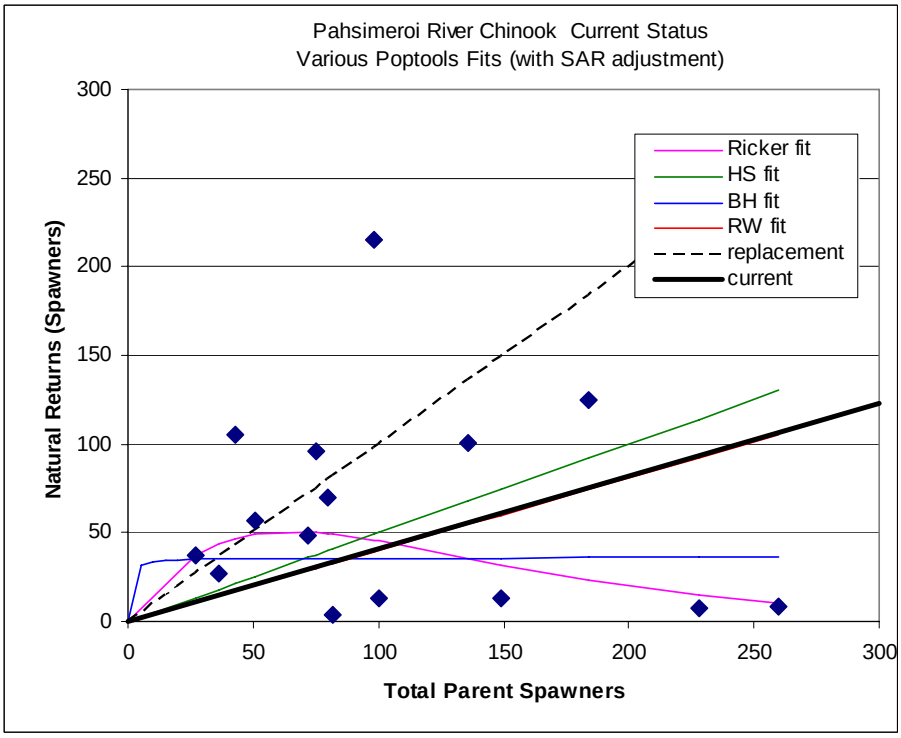

Figure 9. Stock-recruitment curves for the Pahsimeroi River chinook population. Data adjusted for marine survival.